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ABSTRACT

This 1974 annual report of Southern Methodist University (SMU) deals with intentions for 1975-1980 and presents a statistical report and evaluation of trends. Section I, intentions for 1975-80, covers achieving excellence, superior programs, physical plant expansion, minority student program, increasing baccalaureate degrees, an educational venture fund, and a model for minimal doctoral program of high quality. Section II, a statistical report, reviews freshman engineering cooperative program, graduate engineering enrollment, the TAGER television system, graduate degree production, and semester credit hour production. (MJM)

SMU Institute of Technology 1974 Annual Report

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The previous Annual Reports of the Institute of Technology have been addressed to a variety of topics in educational administration and management. Each Report attempted to present a systematic, *quantitative* approach to some specific problem of importance in the management of higher education in science and engineering. Specifically, the following topics have been addressed:

(1) The characteristics of the top engineering schools — 1969 Report

(2) The measurement of academic quality and the indices of excellence — 1970 Report

(3) The quantitative evaluation of faculty performance and the specification of standards of productivity and excellence — 1971 Report

(4) The characteristics of the college-age population dynamics and the American economy as determinants in educational program planning — 1972 Report

(5) New concepts in budgeting and decision making using Zero-Base Budgeting and the techniques of Objectives, Strategies and Tactics — 1973 Report

This, the 1974 Annual Report, attempts to draw these five elements together by presenting a five-year plan for the SMU Institute of Technology for 1975-1980. It is designed to serve as a specific application and example of the general principles covered in earlier Reports.

In common with all other Reports, the 1974 Report closes with a quantitative summary and interpretive analysis of significant factors which occurred during the 1973-74 academic year. Thus, the first part is a look ahead to the future and the second part is a reflective view of the past.

CONTENTS

Foreword

2 **SECTION I**

2 INTENTIONS FOR 1975-1980

2 Achieving Excellence

5 Superior Programs

6 Physical Plant Expansion

7 Minority Student Program

9 Increasing Baccalaureate Degrees

9 AN EDUCATIONAL VENTURE FUND

10 A MODEL FOR A MINIMAL DOCTORAL PROGRAM OF HIGH QUALITY

12 **SECTION II**

12 STATISTICAL REPORT AND EVALUATION OF TRENDS

12 Freshman Engineering Enrollment

12 Undergraduate Engineering Enrollment

13 The Undergraduate Engineering Co-operative Program

14 Graduate Engineering Enrollment

14 The TAGER Television System

16 Graduate Degree Production

16 Master's Degrees

16 Doctoral Degrees

17 Semester Credit Hour Production

18 Appendix I

18 Resident Administration and Faculty of the Institute

21 Appendix II

21 Events Affecting the Faculty

21 Textbook Publications

22 Appendix III

22 Active Grants/Contracts in Force During Fiscal Year 1973-74

26 SMU FOUNDATION FOR SCIENCE AND ENGINEERING

26 Board Officers and Executive Committee

26 Board Members

27 Technical Advisory Council

27 Corporate and Business Donors

28 Individual Donors

Section I INTENTIONS FOR 1975-1980

As explained in the 1973 Report, the first step in long-range planning involves the establishment of well-defined organizational goals. There is often confusion between the meanings attached to *goals* and *objectives*. Here they are used to denote two different classes of *intentions* defined as follows:

(1) A *goal* is an axiological intention whose attainment is a matter of *subjective* judgment. They are always expressed as

To (action word) (object) (qualitative modifier)

(2) An *objective* is an intention whose degree of achievement can be determined by comparison with specific objective measures, often within specified time frames. They are measurable intentions which are always expressed as

To (action word) (object) (quantitaive modifier)

With this understanding of terms, and with overall University intentions provided by the Administration, the intentions for the Institute of Technology were developed. This involved a three-step process. First, a meeting of the Institute administration — Dean, Associate Dean, Assistant Dean for Undergraduate Programs, and Department Heads — was arranged for the purposes of goal setting. After several hours of discussion, a group of commonly understood intentions was developed. As a second step, these were then referred back to the individual departments for review, criticism and addition. All responses received were factored into the original statements. In the third step, the revised intentions were structured into hierarchical form and again were submitted to the faculty for their reaction. Once again, all responses were factored into the statements and into the hierarchical structure. It is worth noting that faculty response and comment in this process can be described most charitably as minimal. For whatever reason, the faculty was essentially passive as far as goal setting was concerned.

The outcome of this process was a group of 14 intentions that are summarized as follows:

1975-1980
Statement of Intentions (Goals and Objectives)

(1) By established measures of performance to stand among the top ten schools of engineering in the nation.
(2) To provide educational programs in support of the service sector of the regional economy.
(3) To provide support for the science, engineering and technology intensive industries of North Texas and other regions.
(4) To assure the existence and availability of excellence in other academic departments of the University which complement and support the Institute of Technology curriculum.
(5) To offer superior programs to superior students in Civil, Electrical, Mechanical and Systems Engineering and in Computer Science and Operations Research.
(6) To develop and complete a set of innovative and excellent undergraduate laboratories.
(7) To double baccalaureate degree output to 150 degrees per year.
(8) To maintain Master's degree output in the range from 125 to 200 per year.
(9) To award *at least* 25 doctorates per year, with 10 or more being the Doctor of Engineering which aims at engineering *practice*.
(10) To secure public recognition of Institute accomplishments — on the campus, in the local North Texas area, and nationally.
(11) To initiate an "open University" pre-engineering program.
(12) To dramatically improve the opportunities for women and minorities as students and faculty within the Institute of Technology.

FIGURE 1

Hierarchy of Intentions

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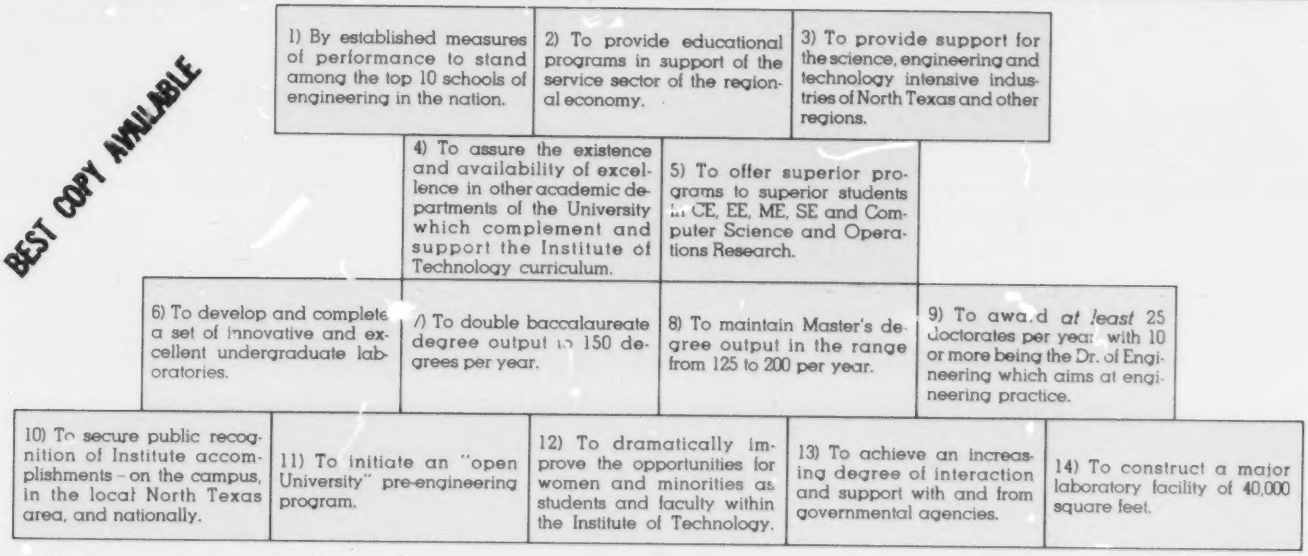
1) By established measures of performance to stand among the top 10 schools of engineering in the nation.
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4) To assure the existence and availability of excellence in other academic departments of the University which complement and support the Institute of Technology curriculum.
5) To offer superior programs to superior students in CE, EE, ME, SE and Computer Science and Operations Research.
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11) To initiate an "open University" pre-engineering program.
12) To dramatically improve the opportunities for women and minorities as students and faculty within the Institute of Technology.
13) To achieve an increasing degree of interaction and support with and from governmental agencies.
14) To construct a major laboratory facility of 40,000 square feet.

(13) To achieve an increasing degree of interaction and support with and from governmental agencies.
(14) To construct a major laboratory facility of 40,000 square feet. The hierarchical arrangement of these intentions is shown in Fig. 1.

The sections that follow cover the general strategies that are being implemented to assure the achievement of these intentions.

Intention 1 — Achieving Excellence

Excellence in engineering and science education programs can be measured. This subject was reviewed at length in the 1970 Annual Report and the review was based upon a landmark publication by the National Science Board entitled [1] "Graduation Education — Parameters for a Public Policy." This document identifies a number of correlates of quality. These were derived by examining those "best" schools identified in the Cartter Report and then determining if there were any correlations between perceived quality and various measurable factors. These were identified as the *correlates of quality*. The authors of the report made it clear that the more correlates of quality demonstrated by a school, the greater its likelihood of being identified with the "best," that the correlates were synergistic. It was also noted that the mere achievement of these performance standards was no guarantee of excellence, but that it was hard to imagine that any school described by such characteristics would not possess a high degree of excellence.

The six most important of these correlates of quality are identified in Table 1. The seventh one, as noted in the 1970 Report, is a measure of minimum faculty productivity in the classroom requisite to quality instruction and minimal exposure of all faculty to students. These factors are all ratios of eight different indices which are readily determined for any school. Their average values for the three-year period 1970-1973 for the Institute of Technology are given in Table 2. The corresponding correlates of quality for SMU, compared to those which characterize the "best" schools, are compiled in Table 3. It is worth noting that SMU performance in all cases except one, equals or exceeds that associated with excellence. The one case in which its performance is somewhat below the standard is a by-product of the large TV graduate program which is the result of strategies supporting Intentions 2, 3 and 8.

[1] Superintendent of Documents, 1969, U. S. Government Printing Office, Washington, D. C. 20402.

TABLE 1

The Measures and the Model of Excellence

(1) Number of doctorates produced per year	25
(2) *Face values of research per year* / Number of full-time faculty	$35,000
(3) *Doctoral degrees per year* / Number of full-time faculty	0.43
(4) *Doctoral degrees per year* / Number of FTE graduate students	0.1
(5) *Doctoral degrees per year* / B.S. degrees per year	0.2
(6) *FTE graduate students* / FTE faculty	4.24
(7) *Student credit hours taught per year* / FTE faculty	250

Thus, it is taken as a part of this plan that Intention 1 — *By established measures of performance, to stand among the top engineering schools of the nation* — can be achieved if Institute and faculty performance is sustained at current levels and preferably improved. This means that the high standards set for faculty performance and identified in the 1971 Annual Report must be continued. It also means that the process of quantitative evaluation of faculty performance begun in 1971 must be continued.

Fig. 2 reproduces the evaluation form described in the 1971 Annual Report. It also shows the average level of faculty performance for that year in each category. Achievement of excellence comparable to the "top 10" schools requires that this performance be improved, particularly in research productivity. Consequently, during the 1975-1980 period, the award of continuation appointments, of tenure, promotions and new faculty acquisitions must be heavily influenced by these performance standards if the intention of national eminence, Fig. 1-(1), is to be achieved.

TABLE 2

SMU Performance Indices

Factor	1970-1973 3-year average
Doctoral degrees per year	32
Master's degrees per year	167
Bachelor's degrees per year	78
Student Credit Hours (SCH)	12,393
Number of full-time faculty	45
Research in force (face value)	$1,716,628
FTE graduate students (SCH/9)	334
FTE faculty	50

TABLE 3

SMU Performance

Factor	Top 10 Model	1970-1973 3-year average SMU
Doctorates per year	25	32
Research (face value) full-time faculty	$35,000	$38,147
Doctorates/year/full-time faculty	0.43	0.71
Doctorates/year/FTE graduate student	0.1	0.096
Doctorates/year/ B.S. degree/year	0.2	0.41
FTE graduate students/ FTE faculty	4.24	15.68
SCH/FTE faculty	250	248
Also note the number of degrees/faculty		6.16

FIGURE 2

Average for 47 Substitute Faculty

Name of Rater _____ Name of Person Rated _____

Date: _____

PERSONAL QUALITIES		Unsatisfactory Lower 10% 0 1	2	Fair 20% 3	4	Good 40% 5	6	Superior 20% 7	8	Outstanding Upper 10% 9 10	Rating	Score Rating X Factor	Adjust Score by	Job Points = Score + Adjust
INITIATIVE	1	Must be told; no personal initiative.		Needs close, frequent, supervision.		Requires average supervision.		Independent; resourceful, acts. 7.66		Highly resourceful and aggressive.	7.66	7.66	±3 0	7.66
Extent to which he sees what needs to be done and gets it done.														
EFFORT FOR UNIT	1	Exerts effort only when forced.		Could do much better than he does. Low effort.		Satisfactory; average motivation.		Hard worker; above average. 7.94		Intense motivation; maximum effort.	7.94	7.94	±3 0	7.94
Motivation to achieve unit goals, without regard to effectiveness.														
RESPONSIBILITY	1	Unreliable, or gives up easily, or evades normal authority lines.		"Gets by, avoids responsibility.		Trustworthy, reliable; average persistence.		Persists in spite of problems. 8.09		Completely reliable; always finishes job at any cost to himself.	8.09	8.09	±3 0	8.09
Dependability, reliability, trustworthiness, persistence.														
PERSONAL RELATIONS	1	Inconsiderate; negative hard to get along with.		Indifferent to needs of others; little effort to cooperate.		Maintains good relations; understands and is attuned to others.		Well-liked by others; encourages cooperation. 7.38		Very sensitive to human nature; skilled at securing cooperation.	7.38	7.38	±3 0	7.38
Effectiveness in dealing with peers and others to achieve unit goals.														
PROFESSIONAL ACTIVITIES	1	Inactive; does not paticipate locally or nationally.		Fairly active locally; attends meetings; not an officer.		Active locally; frequently a local officer; active attendee. Presents 1 paper/year nationally. 5.64		Occasionally holds national committee posts and presents at least 2 papers/year.		Very active nationally and locally ...th frequent offices, committees, papers.	5.64	5.64	±3 0	5.64
Activities in professional societies.														
UNIVERSITY SERVICE	1	Avoids service on committees or guidance and counseling duties.		Seldom nominated for committee work or as a counselor, tends to grumble over "extra" duty.		Occasionally serves on committees, works effectively, but not enthusiastically, accepts assigned guidance/counsel.		Accepts duties in guidance and counseling or on committees in good spirit and works constructively. 7.09		Commonly nominated and serves with enthusiasm and effect.	7.09	7.09	±3 0	7.09
Service on SMU or Institute Committees, in guidance, counseling, student societies, etc.														
RESEARCH PRODUCTION													SUB-TOTAL PERSONAL JOB POINTS = PJP = 43.80	
RESEARCH PRODUCTION	4	Does not submit proposals, does not do research.		Submits few proposals; research usually on SMU funds. Below $15K/yr.		Submits proposals, occasionally successful; $25K per yr. 4.51 average.		Submits many proposals, with frequent success; about $30K-40K per year.		Prolific source of proposals, usually successful, over $50K per year.	4.51	18.02	=10 0	18.02
Effort and relative success in research proposals and funding.														
SCHOLARLY PRODUCTION	2	Does not publish at all, except for class notes.		Occasional papers, no books, no editorships.		Publishes regularly (1 paper — per year), perhaps 1 book. 5.47		Publishes steadily, one or two books, editor possibly.		20 or more publications, over 2 books, nationally recognized.	5.47	10.94	±5 0	10.94
Refers to publication of books, in national "referred" Journals, or serves as editor of such.														
PH.D. PRODUCTIVITY	2	No Ph.D. students enrolled.		Occasional Ph.D. produced or in pipeline.		Produces about 0.5 Ph.D.'s per year or pipeline forecast. 5.33		Attracts large numbers; output over 0.5 per year.		Produces 1 or more Ph.D.'s per year.	5.33	10.66	5 0	10.66
Actually produces or forecasts because of enrollment in pipeline.														
TEACHING													SUB-TOTAL RESEARCH JOB POINTS = RJP = 39.62	
STUDENT INSPIRATION	1	Negative reaction from students.		Deficient in motivating students.		Reasonably successful in motivating students.		Highly effective; good teacher. 7.34		Unusually effective; draws student acclaim.	7.34	7.34	±3 0	7.34
Motivation and inspiration of graduate students.														
TEACHING EFFECTIVENESS	2	Bad teacher; inconsiderate, ill-prepared, indifferent, unfair.		Poor teacher, limited grasp, appears indifferent, often not prepared.		So-so teacher, pedestrian, adequate but not inspiring.		Good teacher, considerate, fair, well prepared, interesting. 7.58		Outstanding teacher; enthusiastic, communicates well, popular.	7.58	15.17	±5 0	15.17
Results of the student evaluation or your impression.														
TEACHING PRODUCTION	2	Below 100 SCH/year.		Approximately 200 SCH/year.		Approximately 300 SCH/year. 5.28		Approximately 350 SCH/year.		Over 400 SCH/year.	5.28	10.55	±5 0	10.55
Total number SCH produced per academic year.														
EDUCATIONAL INNOVATION	2	Teaches same course from same book every year.		Occasionally updates course and/or presentation technique, when pushed.		Changes book and technique fairly often; every year; keeps course up-dated.		Willing to innovate, makes course improvements, but judiciously. 6.78		Makes every effort to bring in new material, new teaching technology, new approaches.	6.78	13.55	±5 0	13.55
Extent to which creativity and imagination, new approaches are utilized.														
ADEQUACY OF PH.D. STUDENT SUPERVISION	2	Students receive little or no direction, contact with advisor random/ineffective.		Minimally adequate faculty direction and supervision.		Students are adequately prepared for dissertation defense, well counseled.		Students well prepared and progress rapidly to degree objectives. 6.20		Vitally involved with students on a continuing, informed basis.	6.20	12.40	±5 0	12.40
													SUB-TOTAL TEACHING JOB POINTS = TJP = 59.01	

Intention 5 — Superior Programs

According to Intention 5, the Institute of Technology will offer superior programs to superior students in Civil, Electrical, Mechanical and Systems Engineering and in Computer Science and Operations Research. There are two degree paths through the Institute of Technology — one in Engineering and one in Applied Science. These paths lead to the following degrees:

Engineering: (Civil, Electrical, Mechanical, Systems)

The B.S.X.E. — The baccalaureate — basically four years

The M.S.X.E. — The Master's — one year past the baccalaureate

The Engineer — One year past the Master's

The Doctorate — Either the Ph.D. or the Doctor of Engineering — basically three years past the baccalaureate

Applied Science: (Computer Science and Operations Research)

The B.A.S. — Bachelor of Applied Science — four years

The M.A.S. — Master of Applied Science

The Ph.D.

Degrees in Applied Science at the M.A.S. and Ph.D. levels, with major concentrations in the previously listed engineering areas, may be sought by students with baccalaureate degrees in the hard sciences and mathematics.

It should be noted that an effort has been made to identify the principal mainstreams of local industry interest and national academic interest, and to do those few things well. For example, no effort is made to cover Chemical, Sanitary or Metallurgical Engineering. The limited resources available must be concentrated into a few areas to produce what F. E. Terman, former Provost of Stanford University, identifies as "steeples of excellence."

The basic plan at SMU is described in detail in that part of this Report entitled "A Model for a Minimal Doctoral Program of High Quality."

Just as it is necessary to select a few major departments to avoid spreading resources too thin, it is correspondingly necessary to select only certain specific academic areas within each major department. Tables 4 through 8, which follow, indicate the areas that are, or are not, *covered* in the SMU program. As used here, the term *covered* means that graduate level research is underway. Obviously, it is necessary to be able to teach, principally at the undergraduate level, in *all* areas and this capability does exist at SMU. But *excellence* at any level in a given subject requires *coverage* in the research sense. Minimal *coverage* has been achieved at SMU.

It is clear from this tabulation that the maximum strength exists in Electrical Engineering. The recent losses of key people must be replaced by senior people if departmental strength and productivity are to be sustained. The most important deficiency in this department is in the area of switched telecommunication systems. The highest priority must be attached to the acquisition of a senior man who can provide leadership and a rallying point for others. Although there are no such programs now in American engineering schools, every school will be trying to start one by 1980. Thus, this is a place where the Institute can provide national leadership and greatly enhance its already good reputation.

A similar situation exists in Mechanical Engineering. In this case the area of nondestructive testing is a "hot" technical area, but absent from the nation's campuses. The establishment of a major program in this area can be achieved at SMU with a relatively small capital outlay. Like telecommunications in electrical engineering, it is an area of rapidly increasing importance in mechanical engineering and in industry, both locally and nationally. Its development at SMU could catapult the Mechanical Engineering Department into a position of national eminence and leadership while simultaneously complementing existing strengths.

TABLE 4

Principal Academic Areas

Civil Engineering

Areas Covered at SMU (Research underway)

Solid Mechanics
Civil Engineering Structures
Soil Mechanics
Water Resources
Environmental Science and Engineering

Areas Not Covered at SMU (Courses are taught; no research)

Graphics and Surveying
Transportation and Traffic
Hydraulics (except in the Fluid Sciences area)
Water Quality
Urban and City Planning — some in Electrical Engineering
Highways
Construction
Coverage in Environmental Science and Engineering and in Soil Mechanics is only marginal

TABLE 5

Principal Academic Areas

Electrical Engineering

Areas Covered at SMU (Research underway)

Electronic Devices
Information Technology
Systems Science and Technology
Networks and Circuits
Biomedical Engineering
Quantum Electronics and Electromagnetics
Societal and Public Systems
Electronic Materials

Areas Not Covered at SMU (Courses are taught; no research)

Energy Technology — Although much of this is covered in Mechanical Engineering in the Thermal Sciences.
Computer Engineering — Although much is found in Computer Sciences Program
Telecommunications

TABLE 6

Principal Academic Areas

Mechanical Engineering

Areas Covered at SMU (Research underway)
- Solid Mechanics
- Thermal and Fluid Sciences and Engineering
- Mechanical Design of Materials
- Environmental Science and Engineering
- Acoustics
- Gas Dynamics

Areas Not Covered at SMU (Courses are taught; no research)
- Controls
- Materials and Manufacturing Processes
- Lubrication
- Tool Engineering
- Petroleum Technology
- Reliability and Quality Control; nondestructive testing
- Coverage in Environmental Sciences and Engineering is only marginal.

TABLE 7

Principal Academic Areas

Computer Science

Areas Covered at SMU (Research underway)
- Computer Systems Software
- Digital Hardware
- Mathematics of Computation

Areas Not Covered at SMU (Courses are taught; no research)
- Management Data Processing
- Artificial Intelligence
- Simulation — Some coverage in Electrical Engineering
- Analog Computers — Well covered in Electrical Engineering as are Hybrid Computers

TABLE 8

Principal Academic Areas

Operations Research

Areas Covered at SMU (Research underway)
- Deterministic Models
- Stochastic Models
- Information Systems

Areas Not Covered at SMU (Courses are taught; no research)
- Decision Processes (Game Theory, Networks, etc.)
- Applications — specifically in such areas as:
  - Health Care
  - Production Control and Scheduling
  - Reliability
  - Transportation Systems

The Systems Engineering Program offered at SMU is one of the first three Systems Engineering Programs to be accredited by the Engineers Council for Professional Development. Although the program resides administratively in the Computer Science/Operations Research Department, the curriculum offers opportunities for the student to concentrate his study in a number of areas including: Industrial Engineering, Operations Research, Manufacturing Engineering, Information and Control Sciences and Computer Science.

Intention 14 — Physical Plant Expansion

This section describes a long-range development plan for the physical plant of the Institute of Technology, a plan which should be satisfactory for virtually any foreseeable future period or changed condition. It has become possible because of recent developments, including the razing of an outdated gymnasium on the campus and plans for a new building for the School of Business Administration which will make available the Fincher Building now occupied by the Business School.

The various activities of the Institute of Technology are currently located in five different buildings which can be briefly described as follows:

	Gross	Net
Caruth Engineering Building	36,834	22,905
Lab Building No. 1 [Solid Mechanics]	6,250	4,658
Lab Building No. 2 [Information & Control Sciences]	10,250	7,853
Lab Building No. 3 [Thermal & Fluid Sciences]	6,280	4,392
Bradfield Computing Laboratory	17,956	11,957
Science Information Center [third floor] [estimated]	8,000	6,000
TOTAL:	85,570	57,765

This is a very small amount of square footage for an operation of the magnitude currently maintained by the Institute of Technology. Except for the addition of the space in the Bradfield Building, this is essentially the same space that was being used eight years ago. It should also be understood that a large portion of the Bradfield Computing Laboratory is used by the entire University community, not just by the Institute of Technology. The same is true of the Caruth Engineering Building because the classrooms in that building are used by all of the University. The Institute has been able to maintain its high level of productivity in degree production, within this small amount of space, because of the large number of industrial classrooms in the TAGER TV system.

As things presently stand, the Institute of Technology is completely locked into a fixed space position with no place to go to develop new programs or even to provide basic minimum facilities necessary for existing faculty members to conduct research. This has been a condition that has characterized Institute status for the last four or five years. The present undergraduate laboratory facilities are inadequate. But there is no way to correct this deficiency because there is not enough surplus space available to the Institute to install proper undergraduate laboratories.

The Fincher Building, which is presently occupied by the School of Business Administration, includes 67,784 gross square feet, or 34,338 net square feet. In addition, it would be possible to build a fourth labora-

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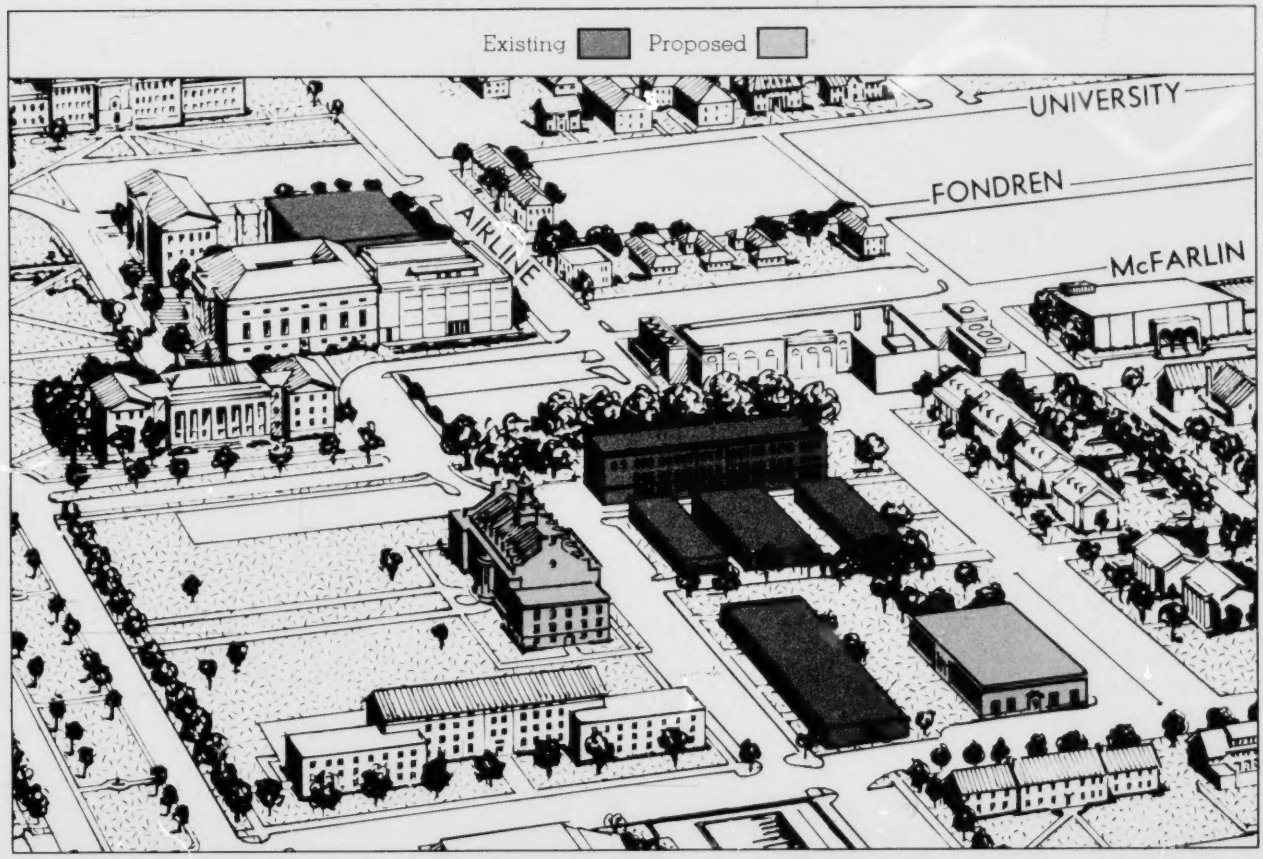
Figure 3

"Existing" and "Proposed" Facilities



tory building, identified as Lab Building No. 4, measuring approximately 275 feet by 125 feet, which would total about 34,375 gross square feet (about 23,031 net) in the space presently occupied by the Girl's Gymnasium and the tennis courts. This fourth laboratory building could be constructed on a concrete slab, one story high at a cost of perhaps $25.00 per square foot, or a total cost of about $860,000. If these two buildings, Fincher and Lab Building 4, were assigned to the Institute of Technology and the space on the third floor of the Science Information Center was vacated, it would give the Institute of Technology a total of 179,759 gross square feet (about 109,134 net square feet), or about twice the space currently available.

Assuming that this space was available to the Institute, the best plan might be to identify the Caruth Engineering Building and Laboratory Buildings 1, 2 and 3 as the physical plant for the Electrical Engineering Department, including Biomedical Engineering. All administrative and other activities should be moved out of the Caruth Building, and into the Fincher Building, with the exception of the four TV studios. The Caruth Engineering Building would then be used for the TV classrooms, graduate student study spaces, faculty offices, and principally for undergraduate laboratories. Laboratory Buildings 1, 2 and 3 would be converted to heavy duty research laboratories, primarily in the Electronic Sciences and Biomedical Engineering. The third floor of the Science Information Center would be vacated.

The new Laboratory Building No. 4 could be designated as the Civil and Mechanical Engineering Building and all activities which had previously been housed in Caruth and in Laboratory Buildings 1 and 3 could be moved into that facility. This is only one possible plan for the use of Laboratory Buildings 1, 2, 3 and 4. Closer analysis may suggest alternative assignments.

The Department of Computer Science and Operations Research would remain in the Bradfield Computing Laboratory. All facilities and personnel not associated with that activity could be moved into Fincher. Furthermore, the department will require some space in Fincher because it is already overcrowded.

This would place all of the nontelevision classrooms, conference rooms, administrative offices, reading rooms for students and so on in the Fincher building. It would be many, many years before the Institute could fully occupy all of this space so that a large proportion of it would be available for general University use. This would make a major increment in office and classroom space available to the University as a whole because most of it is now fully utilized by the School of Business Administration.

It would appear that the foregoing physical plant development could be accomplished with five decision packages at the following approximate costs:

Package Number	Package Name	Cost
Package No. 1	Laboratory Building 4	$860,000
Package No. 2	Refurbish Lab Buildings 1, 2 and 3	25,000
Package No. 3	Move Electronic Sciences out of SIC-3	100,000
Package No. 4	Refurbish Fincher Building	50,000
Package No. 5	Refurbish Caruth Building	50,000

All these estimates may be in error to some degree, but in any event, it is clear that the entire project could be accomplished for less than about one or $1.2 million. Considering the overall magnitude of the project, that is a tremendous bargain by any test.

Intention 12 — Minority Student Program

In the National Conference on the Recruitment of Minority Students that was held in Washington in 1973, the following key points emerged as important factors in the recruitment and retention of minority students in predominantly white schools:

(1) They need tuition assistance in nearly all cases.
(2) In many instances, they come from desperately poor families, whose expectation is that the potential student will work and earn money to contribute to the family expenses. His removal from this enterprise by full-time attendance in school can work hardships upon his family. Consequently, it is imperative that, while he is a full-time student, he be provided with some sort of spending money.
(3) The program must move to precisely the same levels as programs for white students. The minority communities believe that a double standard would be a rip-off that they would not accept.
(4) Assuming that student performances and attitudes are accepted, the companies must be willing to guarantee a job at the end to establish credibility for the program. Too many inducements and promises have been made in the past which have not been kept and credibility of the Establishment is not high.

With these considerations in mind, the following general elements have been incorporated into the SMU Plan:

(1) During the student's first year at SMU, the company would agree to pay full tuition to allow him to go to school full time and would additionally provide him with some sort of stipend for spending money and to contribute to family support.
(2) The company would agree to provide the student with a co-op job for the remainder of his time at SMU with tuition assistance depending on need.
(3) These efforts would be coordinated with any tuition equalization scholarship programs operated by either the State or Federal Government; the purpose of this last provision being to minimize the overall cost to the sponsoring company.
(4) SMU would endeavor to recruit the students, but would welcome nominations from the companies themselves, either from their work force or from children of their employees.
(5) The program is aimed at all minority groups, Negro, Spanish surname and American Indian.

Assuming that a minority student does not receive any financial aid from any source other than his or her sponsoring firm, the cost of sponsoring a student is estimated to be $11,000 in total. This cost figure is based on the following assumptions:

(1) The student will be able to complete the freshman engineering curriculum in two semesters, i.e., he or she will not require remedial work or will not need a summer term to yield a lighter-than-normal load in the regular term.
(2) The sponsoring firm will pay for all of the student's expenses for the freshman year, then only for tuition after this. This is based on the premise that a student will co-op with the firm after his freshman year, and thus, be able to pay for all expenses other than tuition through his co-op earnings.
(3) SMU tuition and fees will not increase beyond $2,450 per year. If it does increase, costs will rise accordingly.

The costs for a student's freshman year will be:

Tuition	$2,200
Room and Board	1,300
Fees	250
Books and Supplies	150
Spending Money @ $50/mo.	450
Total	$4,350

After the freshman year, it is assumed that the student will co-op with his sponsoring firm, and will receive a normal co-op salary. The sponsoring firm will pay the tuition for the student during each school term, and this will total approximately $6,750 (based on 1974-75 charges).

There are a number of other sources for financial aid, including:

(1) Texas Equilization Grants which are provided by the State of Texas for Texas students who wish to attend private universities in Texas. The value of these grants is up to $600 for each academic year.
(2) Basic Educational Opportunity Grants (BEOG's) which are provided by the Federal Government for freshman students who show a rather high degree of financial need. The value of these may be from $500 to $800.
(3) Supplemental EOG's which provide additional funds for students with greater need than is called for in the BEOG program.
(4) Other scholarships which are administered by SMU's Financial Aid Office.

It is anticipated that most of the students who will be selected for the Minority Student Program will be able to receive one or more of these forms of financial assistance. *The cost to the sponsoring firm will be reduced accordingly,* but to an extent that cannot be predicted in advance.

The program has been well received and a number of companies represented on the Board of Directors of the SMU Foundation for Science and Engineering have agreed to sponsor minority students.

Intention 7 — Increasing Baccalaureate Degrees

By late 1972, it was increasingly evident that a critical shortage of engineering baccalaureates would occur by 1975. This was recognized by Texas Instruments Incorporated and a cooperative effort with SMU was undertaken to assure TI's long-range manpower needs. Fortunately, this matched the SMU desire to increase the size of its baccalaureate programs.

Accordingly, the SMU-Texas Instruments Engineering Development Program was established in the Spring of 1973 to provide for the education, on a part-time basis, of 75 TI employees through the Bachelor's degree in engineering. As initially conceived, the participants were to be employed full time by TI, but would be released during the morning hours from 8:00 to 12:00, five days a week, to attend classes on the SMU campus. It should be noted that SMU has three closed-circuit TV channels into Texas Instruments and could provide much of the instruction by TV; however, TI management insisted that all instruction be on campus so that the students could be exposed to the greatest extent possible to an education in a campus environment removed from the conventional in-plant training atmosphere.

The 75 students were to be about equally divided among three areas of interest to TI — Manufacturing Engineering (first identified under Industrial Engineering and later under Systems Engineering), Electrical Engineering, and Mechanical Engineering. The initial selection of students was made from applicants who had completed about two years of college work including mathematics through integral calculus.

The program was to begin in the Fall 1973. It was recognized that refresher type courses would be required during the Summer 1973 for the students who had not been enrolled in formal credit-type courses for a number of years. Accordingly, three noncredit courses were offered during the Summer 1973:

SS 1301 Calculus Review — Part I
SS 1302 Calculus Review — Part II
IC 1305 Fundamentals of Electrical Engineering

Except for the calculus review the refresher courses were fairly conventional lecture sessions. In the calculus review courses, however, lectures were supplemented with video tapes, study guides, and lecture notes (these materials available as Calculus Revisited Parts I, II, III, were purchased from the Center for Advanced Engineering Study at M.I.T.).

Enrolled for the refresher courses during the Summer 1973 were 19 electricals, 13 industrial, and 9 mechanicals. Upon the completion of Calculus Review — Part I, three students had withdrawn from the program and it was clear that almost half of the remaining students needed additional review on the material of Part I. Accordingly, the math class was divided into two groups — one group of 17 students entered a more detailed review of Part I to prepare them to take SMU's third calculus course in a three-course sequence. The other group of 21 students continued with Calculus Review — Part II.

In the Fall of 1973 the program was brought up to full strength with 76 students enrolled. The distribution of these students and changes that occurred during the Fall semester are as follows:

	Enrollment Fall 1973	Withdrawals	Graduated	Enrollment Spring 1974
Electrical	35	3	1	31
Industrial	17	3		14
Mechanical	24	1		23

One year is a relatively short sample time to establish conclusions on what is actually a rather bold experiment in engineering education; however, it is clearly a successful program and is to be expanded by Texas Instruments to have in school continuously for the next several years 100 engineering students at the junior and senior levels. In many respects the educational backgrounds and motivations of these students resemble those of the better World War II Veterans and make this group a welcome addition to the campus.

THE NEED FOR AN EDUCATIONAL VENTURE FUND

It is necessary that an Educational Venture Fund be established by the SMU Foundation for Science and Engineering, and operated by the Foundation in support of the Institute of Technology.

It should be the purpose of this Fund to allow strategic investment of resources to promote future growth of the Institute of Technology, growth in quality or in size or in effectiveness. The Fund would invest in projects which aim to increase Institute revenues from tuition, research and annual giving; alternatively, other projects could aim to reduce expenditures.

In part, the Educational Venture Fund should resemble an endowment fund. That is, one part of the Fund should be permanent and its corpus should not be invaded. Instead, only earnings from this permanent part of the Fund should be invested in proposed educational ventures.

Other parts of the Fund need not be permanent. A particular donor might desire to fund a particular project over a certain specified time frame and provide the funds for that. Other projects might involve a one-time expense which a particular donor might wish to support. Thus, the Fund should have both permanent and nonpermanent components.

It is proposed that the Foundation look to this Educational Venture Fund, rather than to a conventional endowment, to secure the future of the Institute of Technology as an innovative school.

It is imperative that the effort to raise money for this Fund does not interfere with fund raising for annual operations. If that occurred, the diversion of support to new activities could collapse the existing program.

Beginning in 1974-75, the budget of the Institute of Technology will be constructed, as described in the 1973 Annual Report, as a series of rank-ordered decision packages. The annual operating budget will fund those decision packages of the highest rank whose cumulative cost does not exceed Institute revenue from tuition, research and annual giving. Those decision packages falling below this cutoff line will form the creative reserve of projects for consideration for funding from the Educational Venture Fund.

All decision packages in the creative reserve will be approved by the President of SMU, or the Provost, prior to submission to the Foundation for consideration.

The list of decision packages submitted will not be rank ordered when it is submitted to the Foundation.

The Executive Committee of the Foundation will rank order the decision packages with each committee member in attendance having a vote for each decision package. The committee will also set the cutoff line, funding those packages above the line. This identifies the expenditure level permitted from the Fund at that time.

These recommendations will then be presented to the entire Board of the Foundation for their consideration and action.

Strategic decision packages already identified for the 1975-80 time frame include the following:

Package No.	Package Name	Cost
1	Nondestructive Testing	$ 90,000 total
2	Telecommunications	25,000 per year
3	New Laboratory Building	1,000,000
4	Minicomputer	11,000
5	ME Undergraduate Lab	20,000
6	Biomedical Student Support	12,000 per year
7	Undergraduate Hydraulics Lab	30,000
8	Remodeling of Caruth	
9	Remodeling of Lab Bldgs. 1, 2, 3	
10	Remodeling of Fincher	
11	Move Electronic Sciences	

A MODEL FOR A MINIMAL DOCTORAL PROGRAM OF HIGH QUALITY

> ". . . a *minimal* doctoral program of high quality (in science and engineering) might contain at least 7 graduate departments (i.e., minimal groups, not formally or informally structured groups, each containing diverse specialties), a total of 49 faculty members (typically of the rank professor or associate professor) and 343 doctoral students."*

The foregoing specification is based upon the widely accepted concept that any given academic area requires a "critical mass" of faculty members of outstanding qualification to achieve a state of self-sustaining excellence. In general, in an average sort of way, this number is taken to be seven. Thus, sustained excellence requires approximately seven main areas of seven faculty members, each associated with seven doctoral students.

There is nothing absolutely immutable about the number seven. Stanford had one of the two best Chemical Engineering Departments in the country with a faculty of only four. The number required depends upon the excellence of the faculty — the higher the faculty quality, the fewer that are needed. But seven is commonly accepted as a good "center" value for "good" people.

These staffing levels are closely approximated in the SMU Institute of Technology. This is reflected in Table 9 which identifies the seven areas of principal concentration and the staffing level included in the 1974-75 budget. The budget also includes three additional people who serve in full-time nonteaching, nonresearch posts. The principal faculty deficiency is in Information Systems and Sciences, notably in Switched Telecommunications, and it is here that new additions should be made.

*Graduate Education — Parameters for Public Policy, National Science Board, National Science Foundation, 1969, Washington, D. C., p. 102.

TABLE 9

Areas of Concentration (Minimal Groups)

Name	1974-75 Budget Number of Faculty
Computer Science	7.5
Operations Research	5.5
Electronic Science	8.0
Information Systems and Science	4.0
Systems and Control Science	7.0
Solid Mechanics	7.0
Thermal/Fluid Sciences	8.0
	47.0

It should also be understood that seven areas is also a minimum. A higher level of excellence requires a broader spectrum of activity. The next area, the eighth, to be added should be in the field of nondestructive testing with a staffing level rising from one to four over a period of about three years.

Total operating costs are determined primarily by the number of faculty involved in a program, and only in a minor way by the number of administrators. Thus, the foregoing concept of the staffing requirements for a minimal program of high quality can be used to construct an approximate *cost model.*

For example, assume that the faculty consists of 49 faculty members, including the Dean, Associate Dean and Department Heads. Assume that there are three additional full-time administrators not engaged in faculty duties. It is assumed that all 49 faculty members are able and willing to pursue research and direct doctoral students. Because of differing startup and stop dates of research grants and contracts, fluctuations in graduate student enrollment, and changing patterns of funding support, it is assumed that it will never be possible for more than about 80 percent of the faculty to be actively engaged in supported research at the same time. Thus it is assumed that 80 percent of the faculty teach 6 credit hours each term and 3 credit hours in the summer for a total of 15 credit hours per year. The other half of their time is committed to research. As noted above, it is assumed that, even under the most ideal practical conditions, 20 percent of the faculty will not be involved in research or the Ph.D. program. They are assumed to teach 9 credit hours per term, and not at all in the Summer, for an annual average of 18 credit hours. Thus, for the academic year, if F denotes the number of faculty

$$TCH = 0.8\,F\,(12) + 0.2\,F\,(18) = 13.2\,F$$

where TCH = Teaching Credit Hours

This defines the number of courses that can be offered per year. With 49 faculty members, and assuming all

courses are 3 credit hours, this yields about 645 credit hours or about 215 courses per year. This should be an entirely adequate menu of courses for a wide range of student interests, but sufficiently limited to avoid undue dissipation of faculty energies.

The major items of expense can be estimated in a similar way and expressed in terms of the number of faculty F and administrators A. This is illustrated for 14 major items of direct cost in the first column of Table 10. The second column gives the actual funds budgeted in each category in 1974-75 for the Institute of Technology. The last column then gives the predicted expenses for minimal excellence assuming 49 faculty and three administrators. It is apparent that the Institute is not yet up to the minimum expense levels necessary for sustained excellence. The differences arise primarily in the categories of faculty salaries and graduate student support. Faculty salaries are below the model because current staffing is two positions below the model and some present faculty are not capable of original research and do not qualify for the higher average salary indicated by the model. Their inability to acquire outside research support accounts for the difference in the actual funding level for graduate students and that specified by the model. It is interesting to note that total operating costs can be computed from these tables very simply as follows:

$47,135 x F + 19,075 x A = Total Direct Expense

It is obvious that a very good horseback guess comes out at $50,000 per faculty member.

In return for this level of expenditure, faculty *performance* should equal or exceed the levels given in Table 11. Indeed, expense levels should advance to model levels only as faculty productivity reaches and exceeds the levels given in the Table. Achievement of these performance levels requires a substantial increase in enrollment without an increase in faculty. Additionally, a higher proportion of the faculty must secure outside research support at higher funding levels.

TABLE 10

The Cost Model

Unit Costs	1974-75 Budget	Total Model
(1) Total faculty salary F x $25,000	$1,068,840	$1,225,000
(2) Secretarial support 0.3 (F + A) x $6,200	90,695	96,720
(3) Fringe benefits 0.12 (F) x $25,000	107,410	147,000
(4) Travel $650 x (F + A)	32,300	33,800
(5) Supplies $1,000 x F	42,530	49,000
(6) Telephone (connection + LD) $520 (F + A)	26,500	27,040
(7) Equipment $1,000 x F	20,700	49,000
(8) Technician Support $400 x F	16,546	19,600
(9) Typewriters and Maintenance $150 x .3 x (F + A)	1,840	1,840
(10) Contingent reserve $400 x F	0	19,600
(11) Graduate assistants 1.6 x F x $5,800	301,768	454,720
(12) TV Operations 1.1 x F x 2 x $900	92,260	97,020
(13) Scholarships $2,000 x F	98,000	98,000
(14) Administrators A x $16,000	47,700	48,000
TOTAL	$1,947,089	$2,366,340

TABLE 11

The Performance Level

(1) Ph.D. degree output — 25 + per year
(2) B.S. degree output = 125+ per year
(3) M.S. degree output = 125-200 per year
(4) Research grants/faculty member $\geq$ $25,000/year
(5) SCH/faculty member/year $\geq$ 350
(6) Graduate student credit hours/faculty $\geq$ 70

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Section II Statistical Report and Evaluation of Trends

Freshman Engineering Enrollment

Early in 1973, most engineering educators were hopeful that the Fall of 1973 enrollments of freshman engineering students would increase considerably from previous years. However, after registration figures were released for all schools, it appeared that the level of freshman enrollments was down slightly from the 1972 level. See Figure 4. SMU's freshman engineering recruiting program was slightly more successful in that an increase was achieved as compared to the Fall of 1972 freshman enrollment figures.

The percentage of freshmen entering Southern Methodist University and choosing engineering has increased in 1973 and is likely to increase further. This is particularly true since the total number of freshmen entering SMU will probably decline, paralleling the national trend of fewer registrants in four-year college programs. The prospects for any substantial increase in freshman enrollments for the Institute of Technology are not likely for the Fall of 1974, but there is reason to expect some increases in 1975 and 1976. The quality of SMU's freshman engineering students remains high as measured by entrance test scores shown in Figure 5.

Undergraduate Engineering Enrollment

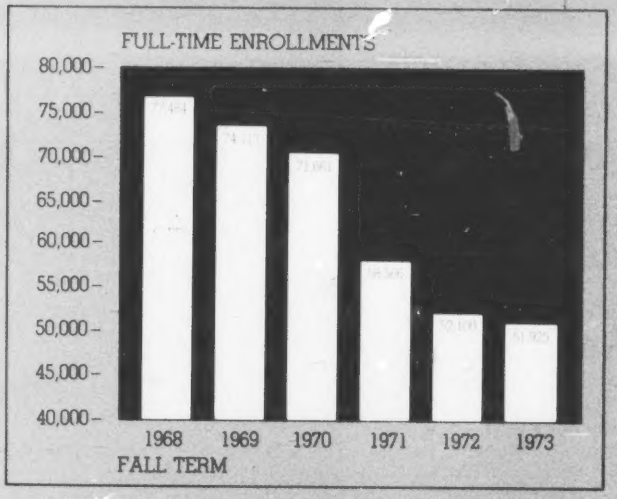
Figure 6 shows a steady decrease in engineering enrollments at the undergraduate level across the country since 1968. Most engineering educators are anticipating a further drop in the undergraduate engineering student population for 1974-75. One of the most important reasons for the shrinking engineering enrollments is the steady decline in the number of freshmen entering engineering schools in recent years along with some serious problems of attrition in engineering programs since 1969.

The undergraduate engineering enrollments at SMU did show an upturn in 1973. This was a result of two factors: One was a lessening of the attrition problem because of increased job opportunities. This appeared to produce an incentive for junior and senior students to stay in engineering programs. The second, and probably most significant factor, was the introduction of the special undergraduate program with Texas Instruments Incorporated of Dallas. Under this new program, which was initiated in the summer of 1972, 64 students were registered in the Fall semester. The students are employees of Texas Instruments and are released part-time to attend regularly scheduled undergraduate course work on the SMU campus. It is anticipated that this program will further impact undergraduate enrollments during the 1974-75 school year with approximately 100 registrants for the Fall semester.

Although the immediate prospects for increasing the undergraduate population in engineering at SMU may appear to be somewhat threatened by decreasing numbers of entering freshmen, the administration of the Institute is confident that the strong career motivation of entering freshmen, along with the steady improvement of the job market for engineers, will serve to encourage more students to stay in engineering programs.

FIGURE 4

Freshman Engineering Enrollment
All Schools Offering Engineering Programs



SMU Institute of Technology

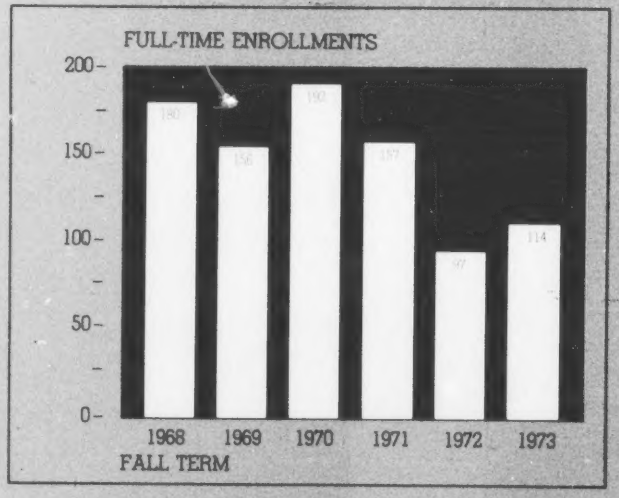


FIGURE 5

Freshman Engineering Student Characteristics

Year	Percent in each H.S. Quartile 1st	2nd	3rd	4th	Average C.E.E.B. Scores Verbal	Math	Composite
1967	79	21	0	0	551	642	1193
1968	81	19	0	0	561	654	1215
1969	82	18	0	0	556	652	1208
1970	85	15	0	0	568	647	1215
1971	89	11	0	0	565	667	1232
1972	87	13	0	0	568	660	1228
1973	83	17	0	0	575	627	1202

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Also, the exploration of other opportunities for attracting upperclassmen will continue to increase the size of the undergraduate enrollment to the point where the doubling of the number of Bachelor's degrees is definitely an achievable goal, see Figure 1, within the next five years.

The likelihood of increasing the undergraduate engineering population at SMU may largely depend on the success of attempts to identify prospective transfer students, and on the further expansion of special programs with industry such as the pilot plan initiated with Texas Instruments in 1972.

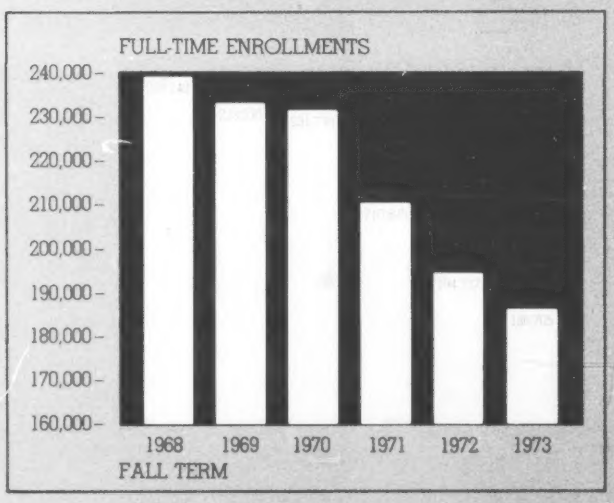
The Undergraduate Engineering Co-Operative Program

The Co-op Program at SMU was a requirement for all students at the time the program originated in 1925. The plan then as now involved the combining of alternating periods of study and engineering work in industry. Voluntary since 1965, the current Co-op Program appears to be holding at a stable number of students for the last three years. For the past several years, virtually all students who have entered the Co-op Program have continued on to earn their Bachelor's degree in engineering. This lack of attrition would indicate that the program provides a very satisfactory experience for the student and the employer. Approximately 80% of the co-op students take a full-time position with their co-op employer after graduation. The industrial demand for co-op students has strengthened considerably in the past two years so that at present the demand for co-op students far exceeds the number of students available. The companies participating in the program in 1972-73 are:

Baylor University Medical Center
Blue Cross-Blue Shield of Texas
Bell Helicopter Company
City of Dallas — Data Processing
Water and Health Departments
City Public Service Board (San Antonio)
Collins Radio Company
Data General Corporation
E-Systems, Incorporated
Engineering Numeric Corporation
General Electric Corporation (Tyler, Texas)
Haggar Company
Albert H. Halff and Associates, Inc.
A. M. Kinney, Inc., Consulting Engineers (Ohio)
LTV Corporation
Mobil Oil Group
Motorola Communications and Electronics, Inc.
NASA
Otis Engineering Corporation
Rosenlund and Company Consulting Engineers
I. W. Santry, Inc.
Southwestern Bell Telephone Company
(Dallas and Houston)
Texas Highway Department
Thurman Spain and Associates
U.S. Air Force (Security Service, San Antonio)
Weben Industries
Xerox Corporation

FIGURE 6

Undergraduate Engineering Enrollments
All Schools Offering Engineering Programs



SMU Institute of Technology

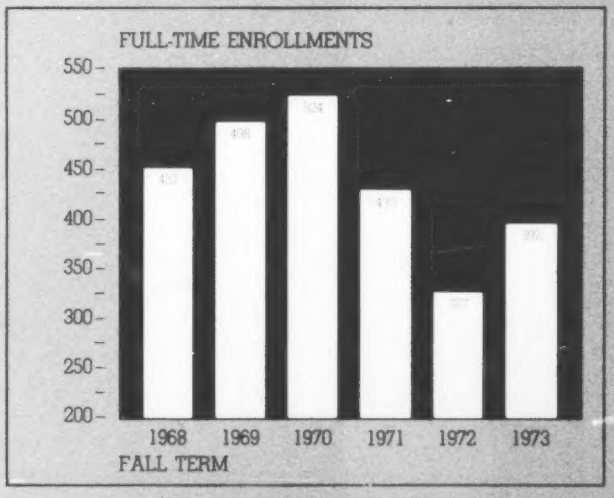
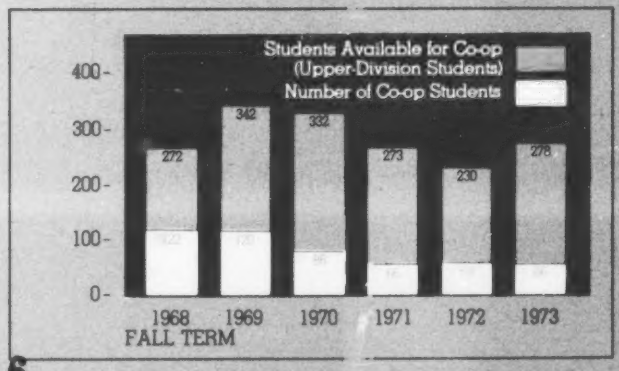


FIGURE 7

Engineering Cooperative Program



Graduate Engineering Enrollment

Figure 8 compares the changes in full- and part-time graduate engineering enrollments from 1968 to 1972 for all schools offering graduate engineering programs. Graduate engineering enrollments for the Institute of Technology are shown using the total full-time equivalent. The changes in enrollment levels for graduate engineering at SMU tend to follow the pattern of the changes recorded for part-time enrollments at all schools. This similarity in the pattern of change in enrollment levels is a reflection of the fact that the graduate student body at SMU includes substantial numbers of students who are employed full-time in industry and take graduate engineering courses via the TAGER Television Network.

The increase in part-time graduate enrollment shown for all schools offering engineering programs, which occurred in 1973, appears to reflect the recent upturn in employment opportunities for engineers. However, the pool of potential graduate engineering students has fallen off since 1969 because of the shrinking undergraduate engineering population. The head-count figure of graduate students enrolled in all engineering schools is down 1.1% in 1973 from the previous year. Similarly, the head count for graduate engineers at SMU is down 1.8% from the 1972 level. See Figure 9.

The flight from engineering which has occurred at the undergraduate level since 1969, removed some of the best students who would have been the most likely candidates for graduate work had they not switched to other fields of study. Thus, not only did the falloff in the production of Bachelor's degrees reduce the number

The TAGER Television System

Most of the graduate courses offered by the Institute of Technology are presented on the TAGER Television Network. The general TV enrollment patterns at the various receiving locations appear in Figure 10.

Figure 11 reveals the general TV enrollment pattern in the various departments and academic centers of the Institute and includes a comparison of off-campus and on-campus enrollments. The impact of recent "new hires" of engineering by the TAGER industrial affiliates is clearly shown in the increase in enrollments recorded for the Spring semester 1974.

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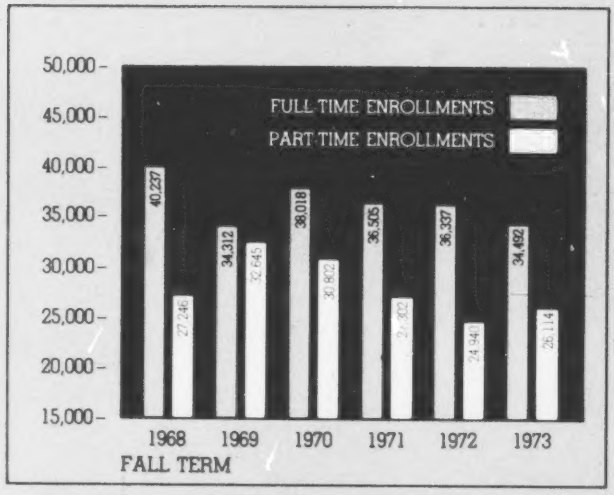
FIGURE 8

Graduate Engineering Enrollment
All Schools Offering Engineering Programs



SMU Institute of Technology

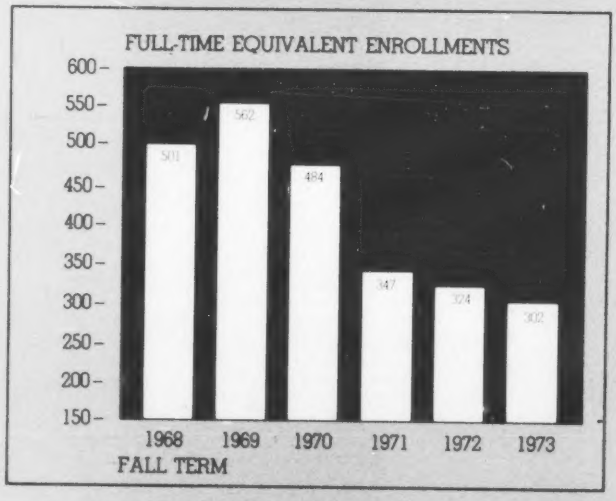


FIGURE 9

Graduate Engineering Enrollment

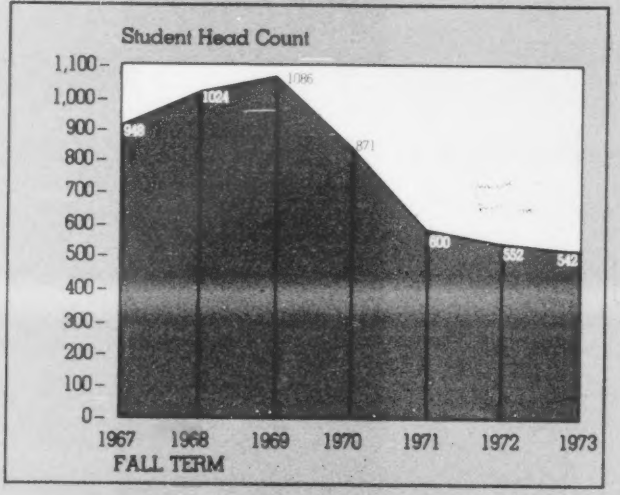


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FIGURE 10

Geographical Distribution of TV Enrollments

	Summer 1972	Fall 1972	Spring 1973	Summer 1973	Fall 1973	Spring 1974
Atlantic Richfield		3	1			
E-Systems — Garland		12	11	1	11	16
General Dynamics	10	28	19	7	25	24
LTV — Grand Prairie	8	19	11	4	9	11
Mobil	1	4	4	1		
Texas Instruments Dallas	53	210	174	74	219	229
Texas Instruments Sherman		1	3		5	4
SMU-On-Campus	65	367	331	201	286	321
Southwestern Medical School		1	2	1	5	
Texas Christian University		5	1			
Univ. of Dallas		3	2	1		
Univ. of Texas at Dallas		4	5	1	4	1
Total	137	657	564	291	564	606

FIGURE 11

Graduate TV Enrollments By Centers (1972-1973) By Departments (1973-1974)

	Summer 1972			Fall 1972			Spring 1973		
Center	off campus	on campus	total	off campus	on campus	total	off campus	on campus	total
Computer Science/ Operations Research	22	46	68	85	196	281	81	172	253
Electronic Sciences	0	0	0	61	43	104	37	24	61
Information/Control	40	11	51	97	91	188	77	78	155
Solid Mechanics	6	4	10	17	18	35	27	25	52
Thermal/Fluid Sciences	4	4	8	19	20	39	11	32	43
Total	72	65	137	279	368	647	233	331	564
	8 Courses			34 Courses			38 Courses		

	Summer 1973			Fall 1973			Spring 1974		
Department	off campus	on campus	total	off campus	on campus	total	off campus	on campus	total
Computer Science/ Operations Research	29	60	89	81	113	194	92	175	267
Electrical Engineering:									
Electronic Sciences	23	10	33	61	24	85	70	27	97
Information/Control	14	14	28	84	103	187	96	70	166
Mechanical Engineering:									
Solid Mechanics	10	5	15	19	21	40	15	28	43
Thermal/Fluid Sciences	4	1	5	9	3	12	12	21	33
Total	80	90	170	254	264	518	285	321	606
	11 Courses			30 Courses			34 Courses		

Graduate Degree Production

Master's Degrees

The number of Master's degrees conferred in 1974 is down slightly from 1973, a continuation of a trend which began in 1970. The recent upturn in off-campus television enrollments would suggest that the number of degrees awarded in 1974 will hold constant, with a possibility of increase in 1975. At the present level of Master's degrees production, SMU continues to hold the position of one of the leading producers of Master's degrees in Texas as well as in all of the South and the Southeast.

Doctoral Degrees

The SMU Institute of Technology conferred its first Ph.D. in 1967 and since that time, 155 doctoral degrees have been conferred. During the early development of the doctoral program, it was decided that the Institute should stay in the mainstream of graduate engineering with emphasis on those programs relating to the needs of local industry. Consequently, for the past six years, primary emphasis has been given to building the doctoral program in Electrical Engineering.

In 1970-71, the Institute's Electrical Engineering Department ranked 9th in the U.S. (tied with the University of Michigan) in the number of Ph.D.'s produced. In 1971-72, the Institute's Electrical Engineering Department had moved to 5th place nationally in the production of Ph.D.'s.

The goal of 25 doctorates a year was originally set for 1972; it was actually reached in 1971. See Figure 14. For the current year, 1973-74, 24 Ph.D.'s in engineering were awarded and one Doctor of Engineering degree was conferred. The doctoral student pipeline seems to be holding up well so that it is anticipated we will continue to confer approximately 25 doctorates a year for the next two or three years.

The Doctor of Engineering Program was started at SMU in 1970. The purpose of the program was to recognize that engineering practice revolves around problem-solving and, as part of the degree program, the student is required to perform a suitable engineering praxis. The interest in the program has continued to grow, and approximately 18 students are enrolled in the Doctor of Engineering Program.

The Engineer's degree, which falls midway between the M.S. and the doctorate, continues to be a definite need. In 1971, 12 students received this degree; 13 were conferred in 1972; 7 in 1973; and 9 in 1974. There are presently approximately 20 students enrolled in this degree program.

Semester Credit Hour Production

The basic unit of academic production is the student credit hour, denoted as the SCH. This is defined as the product of the enrollment in each class multiplied by the semester credits assigned to the course. Data for the past two years are compiled in Figure 15.

FIGURE 12

TV Enrollment

Term	1972-73 Year	1973-74 Year	Difference
Summer	137	291	+154
Fall	661	564	-97
Spring	564	606	+42
Total	1362	1461	+99

FIGURE 13

Master's Degrees in Engineering

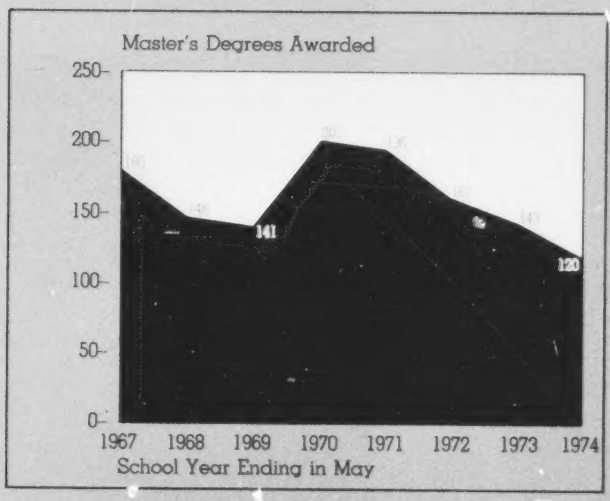

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FIGURE 14

Doctoral Degrees in Engineering

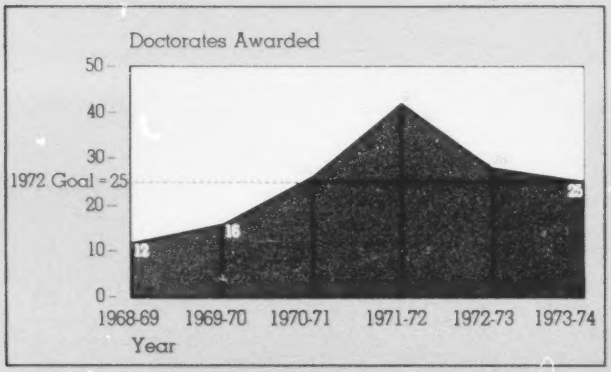

FIGURE 15

Semester Credit Hours Production

Term	Total SCH's	Undergrad. SCH's	Graduate On Campus	SCH's Off Campus	Produced Grad. Total
Summer 1972	1,160	302	450	408	858
Fall 1972	5,121	2,192	2,155	774	2,929
Interterm 1973	6	0	6	0	6
Spring 1973	4,495	1,793	2,003	699	2,702
Total	10,782	4,287	4,614	1,881	6,495
Summer 1973	1,344	491	613	240	853
Fall 1973	5,183	2,600	1,821	762	2,583
Spring 1974	4,901	2,303	1,743	855	2,598
Total	11,428	5,394	4,177	1,857	6,034

FIGURE 16

Expense Budget*

Item	1972-73	1973-74	Projected 1974-75
OFFICE OF THE DEAN			
Gen. Adm.	$ 249,621	$ 275,540	$ 321,916
Comm. Media	42,862	51,937	41,887
Foundation	110,241	36,834	34,240
Machine Shop	12,358	11,476	12,366
Computer Sci./Opr. Res.	276,434	297,861	381,939
Electronic Sciences (1)	207,399	—	—
Info. & Control Sciences (1)	237,391	—	—
Electrical Eng. Dept. (1)	—	491,306	527,728
Solid Mechanics (2)	153,645	—	—
Thermal & Fluid Sciences (2)	164,846	—	—
Civil & Mech. Eng. Dept. (2)	—	296,382	374,511
Academic Computing Lab.	—	196,950	228,000
TOTAL	$1,454,797	$1,658,286	$1,922,587

(1) and (2) Formation of Departments.

*Non-Federal Funds.

Revenue/Expense Summary*

Item	1972-73	1973-74	1974-75
REVENUE			
Tuition Income	$ 673,374	$ 789,043	$ 932,227
Fringe Benefits	30,879	—	—
Univ. College Counsel	11,000	—	—
TV Surcharge	69,090	76,440	88,3[illegible]
Research Overhead	37,296	—	—
SMU Found. Sci./Engr.	633,158	621,282	650,000
SMU Computer Allocation	—	196,950	228,000
TOTAL REVENUE	$1,454,797	$1,683,715	$1,898,587
EXPENSES	$1,454,797	$1,658,286	$1,922,587
Difference		(+ 25,449)	(– 24,000)

*Non-Federal Funds.

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Appendix I Resident Administration and Faculty of the Institute

RESIDENT ADMINISTRATION— As of May 31, 1974

Thomas L. Martin, Jr., Ph.D.
Dean of The Institute of Technology
Leon Cooper, Ph.D.
Associate Dean of The Institute of Technology
Jack W. Harkey, B.S.M.E.
Assistant Dean of The Institute of Technology
George P. Schmaling, B.S.E.E.
Assistant Dean for Industrial Relations
Peter Van't Slot, M.B.A.
Assistant Dean for Institute Development
Finley W. Tatum, Ph.D.
Assistant Dean-Undergraduate Division
James King, C.P.A.
Finance Officer of The Institute of Technology
Robert Dupree
Engineer: TV System
Barbara Babcock
Director of Academic Records

FACULTY — As of May 31, 1974

Department of Computer Science and Operations Research

Resident Faculty

U. Narayan Bhat
Professor and Department Head
Ph.D. (Stat.) University of Western Australia
Leon Cooper
Associate Dean and Professor
Ph.D. (Ch.E.) Washington University
John L. Fike, Jr.
Assistant Professor
Ph.D. (C.S.) Southern Methodist University
Dennis J. Frailey
Associate Professor
Ph.D. (C.S.) Purdue University
Myron Ginsberg
Assistant Professor
Ph.D. (C.S.) University of Iowa
Jeff L. Kennington
Assistant Professor
Ph.D. (I.E.) Georgia Tech
Robert R. Korfhage
Professor
Ph.D. (Math) University of Michigan
Larry J. LeBlanc
Assistant Professor
Ph.D. (O.R.) Northwestern University
David W. Matula
Professor
Ph.D. Engr. Science (O.R.) University of California, Berkeley
William C. Nylin
Assistant Professor
Ph.D. (C.S.) Purdue University
Robert J. Smith, II
Associate Professor
Ph.D. (C.S.) University of Missouri-Rolla

Visiting Industrial Professors

Charles R. Blackburn, II
Assistant Professor
MBA (O.R.) Tulane University
Mary W. Cooper
Assistant Professor
Ph.D. (O.R.) Washington University
J. Gerry Purdy
Assistant Professor
Ph.D. (C.S. and Exercise Physiology)
Stanford University

Department of Electrical Engineering

Resident Faculty

Kenneth L. Ashley
Professor
Ph.D. (E.E.) Carnegie-Mellon University
Jerome K. Butler
Professor
Ph.D. (E.E.) University of Kansas
Shirley S. C. Chu
Associate Professor
Ph.D. (Chem.) University of Pittsburgh
Ting L. Chu
Professor
Ph.D. (Chem.) Washington University
Jon W. Eberle
Associate Professor
Ph.D. (E.E.) Ohio State University
Yumin Fu (deceased)
Associate Professor
Ph.D. (E.E.) University of Illinois
Someshwar C. Gupta
Professor
Ph.D. (E.E.) University of California at Berkeley
Kenneth W. Heizer
Professor
Ph.D. (E.E.) University of Illinois
Lorn L. Howard
Professor
Ph.D. (E.E.) Michigan State University
William F. Leonard
Professor
Ph.D. (E.E.) University of Virginia
Thomas L. Martin, Jr.
Professor
Ph.D. (E.E.) Stanford University
Louis R. Nardizzi
Associate Professor
Ph.D. (E.E.) University of Southern California
Behrouz Peikari
Associate Professor
Ph.D. (E.E.) University of California at Berkeley
Andrew P. Sage
Professor and Department Head
Ph.D. (E.E.) Purdue University
John A. Savage
Professor
M.S. (E.E.) University of Texas

Edmund W. Schedler
Associate Professor
M.S. (E.E.) Oklahoma State University
Mandyam D. Srinath
Professor
Ph.D. (E.E.) University of Illinois
Finley W. Tatum
Professor
Ph.D. (E.E.) Texas A&M University
Chelsea C. White
Assistant Professor
Ph.D. (E.E.) University of Michigan

Adjunct Faculty in the Biomedical Engineering Program

C. Gunnar Blomqvist
Assistant Professor of Internal Medicine
M.D. University of Lund
Ivan E. Danhof
Associate Professor of Physiology
M.D. University of Texas Southwestern Medical School
Javad Fiuzat
Associate Professor of Thoracic and Cardiovascular Surgery
M.D. University of Tehran
Charles F. Gregory
Professor of Orthopedic Surgery
M.D. Indiana University School of Medicine
Robert L. Johnson, Jr.
Professor of Internal Medicine
M.D. Northwestern Medical School
Robert M. Lebovitz
Assistant Professor of Physiology
Ph.D. (Neurophysics) University of California
Jere H. Mitchell
Professor of Internal Medicine and Physiology
M.D. University of Texas Southwestern Medical School
Robert W. Noble
Associate Professor of Internal Medicine
M.D. University of Texas Southwestern Medical School
Steven P. Pakes
Associate Professor of Veterinary Medicine
Ph.D. (Veterinary Pathology) Ohio State University
Louis H. Paradies
Associate Professor of Orthopedic Surgery
M.D. Northwestern Medical School
William J. Rea
Assistant Professor of Thoracic and Cardiovascular Surgery
M.D. Ohio State University College of Medicine
William E. Romans
Assistant Professor of Biophysics
M.S. (E.E.) Southern Methodist University
Ernest M. Stokely
Assistant Professor of Biomedical Engineering
M.D. University of Texas Southwestern Medical School
Winfred L. Sugg
Associate Professor of Thoracic and Cardiovascular Surgery
M.D. University of North Carolina School of Medicine
Gordon H. Templeton
Assistant Professor of Physiology
Ph.D. (Biophys.) University of Texas Southwestern Medical School
John C. Vanatta
Professor of Physiology
M.D. Indiana University School of Medicine
Hal T. Weathersby
Professor of Anatomy
Ph.D. (Anatomy) Tulane University

Visiting Industrial Professors

William S. Ewing
Assistant Professor
Ph.D. (E.E.) Southern Methodist University
Alan L. McBride
Assistant Professor
Ph.D. (E.E.) Southern Methodist University
Theo J. Powell
Assistant Professor
Ph.D. (E.E.) University of Illinois

Department of Civil and Mechanical Engineering

Resident Faculty

Charles E. Balleisen
Professor
M.S. (M.E.) MIT
Harold A. Blum
Professor
Ph.D. (Ch.E.) Northwestern University
Jan Cernosek
Associate Professor
Ph.D. (Exper. Mech.) Technical University of Prague
Michael A. Collins
Associate Professor
Ph.D. (C.E.) MIT
LeVan Griffis
Professor
Ph.D. (C.E.) California Institute of Technology
Jack P. Holman
Professor and Department Head
Ph.D. (M.E.) Oklahoma State University
Robert M. Jones
Associate Professor
Ph.D. (Appl. Mech.) University of Illinois
W. Scott McDonald, Jr.
Associate Professor
Ph.D. (E.M.) University of Kansas
Bijan Mohraz
Associate Professor
Ph.D. (C.E.) University of Illinois
Roger L. Simpson
Associate Professor
Ph.D. (M.E.) Stanford University
Cecil H. Smith
Associate Professor
Ph.D. (C.E.) University of Texas
Henry W. Stoll
Assistant Professor
Ph.D. (M.E.) University of Illinois

Hal Watson, Jr.
Associate Professor
Ph.D. (E.M.) University of Texas
Edmund E. Weynand
Professor
Sc.D. (M.E.) MIT
Marion W. Wilcox
Professor
Sc.D. (Engr. Sci.) University of Notre Dame
W. Gerald Wyatt
Associate Professor
Ph.D. (M.E.) University of Minnesota

Visiting Industrial Professors
Richard P. Bywaters
Assistant Professor
Ph.D. (M.E.) Southern Methodist University
Kondhamur S. Rajagopalan
Assistant Professor
Ph.D. (C.E.) University of Texas
Wayne L. Sanders
Assistant Professor
MSME Lamar State College

Appendix II Events Affecting the Faculty

New Appointments

Dr. Henry W. Stoll, Assistant Professor of CEME, received his Ph.D. degree from the University of Illinois. He specializes in Mechanical Design and joins the faculty of the Department of EC/ME as Professor, September 1, 1974.

Dr. Chelsea C. White received his Ph.D. from the University of Michigan. He joins the faculty of the Department of Electrical Engineering as Assistant Professor on September 1, 1974.

Dr. David W. Matula joins the faculty of the Department of Computer Science and Operations Research as Department Head on August 15, 1974. Dr. Matula received his Ph.D. from the University of California at Berkeley.

Promotions

Effective Fall Semester 1974:

Jerome K. Butler, to Professor
Dennis J. Frailey, to Associate Professor
Robert Jones, Associate Professor, given tenure
William F. Leonard, to Professor
Behrouz Peikari, Associate Professor, given tenure
Robert J. Smith II, to Associate Professor

Changes and Leaves

On August 15, 1974, Dr. U. Narayan Bhat resigned as the Head of the Department of Computer Science and Operations Research. He will continue to serve as Professor in the Department.

Dr. Kenneth L. Ashley will serve as Acting Department Head of the Department of Electrical Engineering as of September 1, 1974. He will continue on as a Professor in the Department.

Resignations

Dr. Alan Wheeler, Associate Professor of Computer Science and Operations Research for the four-year period from September, 1971 to May, 1974, resignation effective May 31, 1974.

Dr. William N. Carr, Professor of Electrical Engineering, completed his terminal leave of absence, resignation effective June 30, 1974, and is now General Manager of Zentron Equipment Corporation.

Dr. Thomas P. Hughes, Professor of History, resignation effective June 1, 1973, has accepted the position of Professor in the Department of History and Sociology of Science at the University of Pennsylvania.

Dr. Andrew P. Sage, Professor and Head of the Department of Electrical Engineering for the seven and one-half year period from April, 1967, to August, 1974, resignation effective August 31, 1974, has accepted the Lawrence R. Quarles Chair and an Associate Deanship at the University of Virginia.

Dr. Charles R. Vail has resigned his post as Vice President of the University and Professor in the Department of Electrical Engineering, resignation effective June 30, 1973, and is now Associate Dean of the College of Engineering at Georgia Institute of Technology.

Textbook Publications

LEON COOPER, Ph.D. (Washington University)
Professor and Associate Dean of the Institute of Technology

Nonlinear Programming, Aloray, Inc., May, 1974.
Methods and Applications of Linear Programming, with D. I. Steinberg, W. B. Saunders and Company, May, 1974.

JACK P. HOLMAN, Ph.D. (Oklahoma State University)
Professor and Department Head

Thermodynamics, McGraw-Hill Book Company: 1st edition, june, 1969; 2nd edition, 1974.

ROBERT R. KORFHAGE, Ph.D. (University of Michigan)
Professor

A Second Course in Calculus, with H. Flanders and J. J. Price, Academic Press, 1974.
Discrete Computational Structures, Academic Press, 1974.

Appendix III Active Grants/Contracts in Force During Fiscal Year 1973-74

Number	Description	Principal Investigator	Amount
80-60	**Title:** "Amphoteric Dopants in the Active Region of GaAs Lasers" Sponsor: Department of the Army, DAAK02-73-C-0226 Duration: April 1, 1973 to December 31, 1973	K. L. Ashley	$ 15,000
80-67	**Title:** "A Methodology for the Analysis of Multi-Arrival Queueing Systems" Sponsor: ONR-N00014-72-A-0296-003 Duration: September 1, 1973 to December 31, 1974	U. N. Bhat	$ 16,851
85-05	**Title:** "Analysis of Some Queueing Systems" Sponsor: N S F GK-19537 Duration: September 1, 1970 to April 30, 1974	U. N. Bhat	$ 90,396
86-81	**Title:** "Solar Energy Collection Systems" Sponsor: Dallas Power and Light Company Duration: July 1, 1973 to June 30, 1974	H. A. Blum	$ 10,000
87-01	**Title:** "Solar Energy Pilot System" Sponsor: Fair Foundation Duration: June 1, 1973 to May 31, 1975	H. A. Blum	$ 30,000
87-92	**Title:** "Solar Energy Applications Research" Sponsor: Alcoa Foundation Duration: November 13, 1972 to December 31, 1974	H. A. Blum	$ 20,000
88-68	**Title:** "Massive Solar Energy Applications" Sponsor: NSF Institutional Grant (84-92) Duration: August 1, 1972 to July 31, 1973	H. A. Blum	$ 2,650
80-43	**Title:** "Study of Semiconductor Laser Modal Fields and Their Radiation Patterns" Sponsor: USAMERDC-DAAK02-71-C-0263, P00001 Duration: May 4, 1971 to July 3, 1973	J. K. Butler	$ 30,658
80-59	**Title:** "Electromagnetic Field Studies in Solid State Injection Lasers" Sponsor: Department of the Army, DAAK02-73-C-0154 Duration: January 19, 1973 to December 31, 1973	J. K. Butler	$ 16,216
83-44	**Title:** "Optical Field Distributions and Model Selection Properties of GaAs (ALGA) as Lasers" Sponsor: N.A.S.A. (Multidisciplinary Grant) Duration: June 1, 1971 to December 31, 1973	J. K. Butler	$ 19,151
86-78	**Title:** "Photoelastic Analysis of Helicopter Structures" Sponsor: Bell Helicopter Company Duration: April 1, 1973 to December 31, 1973	J. Cernosek	$ 15,000
86-88	**Title:** "Investigation of Inter-Laminar Stresses in Fiber Reinforced Composites" Sponsor: Bell Helicopter Company Duration: February 1, 1974 to June 15, 1974	J. Cernosek	$ 10,387
83-32	**Title:** "Boron Arsenide Luminescent Devices" Sponsor: N.A.S.A.-N.G.R.-44-007-042 Duration: July 1, 1970 to June 30, 1974	T. L. Chu	$ 127,292
85-42	**Title:** "Low-Cost Thin Film Polycrystalline Silicon Solar Cells" Sponsor: NSF-GI 38931 Duration: June 1, 1973 to November 30, 1974	T. L. Chu	$ 160,441
87-07	**Title:** "Crystal Structure Studies of Heterocyclic Sulfur Compounds" Sponsor: Welch Foundation N-495 Duration: May 1, 1972 to April 30, 1974	S. Chu	$ 24,443
87-17	**Title:** "Crystal Structure Studies of Tricyclic Compounds" Sponsor: Welch Foundation N-495 Duration: May 1, 1974 to April 30, 1976	S. Chu	$ 27,150

Number	Description	Principal Investigator	Amount
86-07	**Title:** "Optimal Operating Policy for Metropolitan Multiple Water Supply Reservoir System" Sponsor: OWRR 14-31-0001-3739 Duration: June 1, 1972 to July 31, 1974	M. Collins	$ 113,507
82-88	**Title:** "Supply Allowance for Douglas E. Whitley" Sponsor: HEW PHS 1F03 GM55506-01 Duration: November 1, 1972 to October 31, 1973	J. W. Eberle	$ 1,000
82-90	**Title:** "Supply Allowance for Herbert K. Hagler" Sponsor: HEW PHS 1F03 GM55621-01 Duration: November 1, 1972 to October 31, 1974	J. W. Eberle	$ 2,000
85-49	**Title:** "Research Initiation — Predicting Fault Detectability in Digital Networks" Sponsor: NSF GK-42073 Duration: April 1, 1974 to March 31, 1976	J. L. Fike	$ 18,121
84-94	**Title:** "Undergraduate Research Participation" Sponsor: N S F GY-7383 Duration: January 1, 1970 to July 31, 1973	D. J. Frailey	$ 22,150
88-57	**Title:** "A Study of Storage Allocation Methods for Simple Data Structures" Sponsor: SMU "Seed" Grant Duration: June 1, 1971 to June 30, 1973	D. J. Frailey	$ 5,925
88-75	**Title:** "Development of a Computer Bilateral Method for Solution of Ordinary Differential Equations" Sponsor: SMU "Seed" Grant Duration: June 1, 1973 to January 31, 1975	M. Ginsberg	$ 6,000
80-51	**Title:** "Minimum Rate Digital Voice Transmission" Sponsor: Defense Communication Agency #100-72-C-0023 Duration: May 1, 1972 to June 30, 1973	S. C. Gupta	$ 50,527
83-39	**Title:** "Digital Communications for Aircraft" Sponsor: N.A.S.A.-NGR 44-007-049 Duration: January 1, 1971 to August 31, 1974	S. C. Gupta	$ 94,635
82-84	**Title:** "Air Pollution Control Fluidized Vortex Incineration" Sponsor: Environmental Protection Agency R-801078 Duration: May 1, 1972 to October 30, 1973	J. P. Holman	$ 33,041
85-20	**Title:** "Experimental and Analytical Studies of Jet Boiling Cooling Techniques" Sponsor: N S F GK-24637 Duration: September 1, 1971 to February 28, 1974	J. P. Holman	$ 35,568
82-79	**Title:** "Fellowship Supply Allowance for Charles L. Meyers, Jr." Sponsor: HEW-1-F03-GM52121-01-BEN Duration: August 1, 1971 to July 31, 1973	L. L. Howard	$ 1,000
80-61	**Title:** "Plastic Volume Change Effects in Deformation of Graphitic Materials" Sponsor: Wright-Patterson AFB, F33615-73-C-5124 Duration: March 1, 1973 to September 30, 1974	R. M. Jones	$ 24,296
80-63	**Title:** "Mechanics of Composite Materials with Different Moduli in Tension and Compression" Sponsor: AFOSR-73-2532 Duration: June 1, 1973 to May 31, 1974	R. M. Jones	$ 25,050
80-65	**Title:** "Mechanics of Composite Materials with Different Moduli in Tension and Compression" Sponsor: ONR No. N00014-72-A-0296 Duration: April 1, 1973 to March 31, 1974	R. M. Jones	$ 10,555
87-21	**Title:** "Plastic Deformation of Graphitic Materials" Sponsor: Weiler Research, Inc. Duration: May 1, 1974 to June 30, 1974	R. M. Jones	$ 3,000

Number	Description	Principal Investigator	Amount
88-81	**Title:** "Development of an Efficient Technique for Equilibrium Traffic Assignment of Urban Networks" Sponsor: SMU "Seed" Grant Duration: January 1, 1974 to August 31, 1974	L. J. LeBlanc	$ 6,000
80-52	**Title:** "Characterization and Optimization of Infrared Detector" Sponsor: WPAFB (4950 Test Wing) F33615-72-C-1818 Duration: June 1, 1972 to December 31, 1974	W. F. Leonard	$ 70,977
83-46	**Title:** "Vacuum Deposition and Characterization of III-V Antimonide Alloys" Sponsor: N.A.S.A. (Multidisciplinary Grant) Duration: June 1, 1971 to December 31, 1973	W. F. Leonard	$ 14,288
85-29	**Title:** "Thermoelectric Power of Noble Metals" Sponsor: N S F GH-33178 Duration: March 15, 1972 to February 28, 1974	W. F. Leonard	$ 68,475
87-23	**Title:** "Demonstration Project in the Application of Instructional Technology to the Undergraduate Engineering Laboratory" Sponsor: Sloan Foundation Duration: May 1, 1974 to December 31, 1974	W. F. Leonard	$ 25,055
83-29	**Title:** "Photoelastic Model for the Evaluation of Axisymmetric Composite Structures" Sponsor: N.A.S.A. (Multidisciplinary Grant) Duration: September 1, 1968 to December 31, 1973	W. S. McDonald	$ 18,170
85-25	**Title:** "Cooperative College-School Science Programs" Sponsor: N S F GW-7078 Duration: January 4, 1972 to June 30, 1973	L. Nardizzi	$ 32,664
85-32	**Title:** "Instructional Scientific Equipment Program' Sponsor: N S F G4-10155 Duration: July 1, 1972 to June 30, 1974	L. Nardizzi	$ 17,600
85-45	**Title:** "Engineering Analysis of the Cardiovascular System" Sponsor: N S F GK-41467 Duration: January 15, 1974 to June 30, 1975	L. Nardizzi	$ 25,334
88-76	**Title:** "Modeling, Simulation and Analysis of the Cardiovascular System" Sponsor: SMU "Seed" Grant Duration: June 1, 1973 to May 31, 1974	L. Nardizzi	$ 3,000
88-74	**Title:** "Study of an Automatic Reorganization System for Modular Programs" Sponsor: SMU "Seed" Grant Duration: April 1, 1973 to August 31, 1973	W. C. Nylin, Jr.	$ 5,964
80-54	**Title:** "Development of a Configuration Concept of a Speech Digitizer Based on Adaptive Estimation Techniques" Sponsor: Defense Communications Agency 100-72-C-0036 Duration: June 1, 1972 to August 31, 1973	A. P. Sage	$ 131,034
85-31	**Title:** "System Identification in Large-Scale Systems" Sponsor: N S F GK-33348 Duration: September 1, 1972 to August 31, 1973	A. P. Sage	$ 37,994
85-43	**Title:** "A Hierarchical Approach in Large-Scale Systems" Sponsor: N S F-GK-40320 Duration: September 15, 1973 to September 14, 1975	A. P. Sage	$ 61,608
80-48	**Title:** "Making Laser Anemometer Measurements in a Separating Boundary Laser Produced by an Adverse Pressure Gradient" Sponsor: AROD-DA-ARO-D-31-124-72-G31 Duration: October 1, 1971 to September 30, 1973	R. L. Simpson	$ 28,651
80-66	**Title:** "Measurements and Flow Prediction of a Separating Boundary Layer" Sponsor: AROD DAHC04-74-G-0024 Duration: October 1, 1973 to September 30, 1974	R. L. Simpson	$ 15,635

Number	Description	Principal Investigator	Amount
85-07	**Title:** "Hot-Film Anemometer Measurements of Concentration in Turbulent Flow" Sponsor: N S F GK-20016 Duration: November 15, 1970 to April 30, 1975	R. L. Simpson & W. G. Wyatt	$ 65,413
86-85	**Title:** "Relaminarization Phenomena as Produced in Nozzles and Turbines" Sponsor: Purdue University Sub-Contract ONR-N00014-67-A-0226-0005 Duration: October 1, 1973 to September 30, 1974	R. L. Simpson	$ 20,000
88-78	**Title:** "Automation of Psychiatric Information at Parkland Memorial Hospital" Sponsor: SMU "Seed" Grant Duration: June 1, 1973 to December 31, 1973	R. J. Smith	$ 5,894
80-42	**Title:** "Analysis and Synthesis of Diagnosis and Design Techniques for Digital Systems Requiring High Maintainability/Reliability" Sponsor: DNR-N00178-71-C-0148 Duration: January 1, 1971 to August 31, 1973	S. A. Szygenda	$ 211,174
85-16	**Title:** "Fellowship for S. K. Jones" Sponsor: NSF-7131-12 Duration: June 1, 1971 to August 31, 1973	F. W. Tatum (J. E. Brooks)	$ 6,100
83-45	**Title:** "Dynamics of Flexible Spacecraft" Sponsor: N.A.S.A. (Multidisciplinary Grant) Duration: January 1, 1972 to December 31, 1973	H. Watson	$ 22,573
86-35	**Title:** "Waco Noise Monitoring Data" Sponsor: E.P.A. 4FO-00690 Duration: December 1, 1973 to April 1, 1974	H. Watson	$ 2,327
83-34	**Title:** "Film Conductance Coefficients" Sponsor: N.A.S.A. (Multidisciplinary Grant) Duration: June 1, 1969 to December 31, 1973	W. G. Wyatt	$ 21,344
86-84	**Title:** "R & D of Gray Vapor Generator" Sponsor: Gray Company Enterprises, Inc. Duration: October 1, 1973 to May 31, 1974	W. G. Wyatt	$ 7,280
		TOTAL	$1,986,564

SMU FOUNDATION FOR SCIENCE AND ENGINEERING

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Texas Instruments Incorporated

Mr. Jerry S. Stover — Vice Chairman
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Dr. Thomas L. Martin, Jr. — President
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Southern Methodist University

Mr. Charles M. Mayhew — Vice President
Director
Gardner-Denver Company

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